

THE AFRICAN CROWNED CRANES

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FOUR Crowned Cranes have been described, all from Africa. They belong to the family Gruidae and the subfamily Balearicinae which contains only one genus, *Balearica*. The characters are: bill shorter than the head; nostrils oval; a tuft of straw-like feathers on the nape; no convolutions of the trachea within the sternum.

Brasil (1913, *in* Wytzman), Jackson (1938), Chapin (1939), Roberts (1951), and Vincent (1952) classified the Crowned Cranes of east and South Africa as *Balearica regulorum*. Peters (1934) and Benson (1960) classified them all under *Balearica pavonina*. I am separating the two groups (see Fig. 1).

Allan Brooks, Jr. (verbal) stated that there is a gradual intergradation in general body plumage and face markings of cranes across Uganda, from Lake Victoria to the Sudan border, but I have been unable to find enough specimens to show this. The cranes about Entebbe, Uganda, and from Kenya, however, are much larger and lighter colored than those in Sudan. In the Sudan Crowned Crane about one-third of the upper portion of the cheek patch is colored white while the lower portion is pink or reddish. In the East and South African Crowned Cranes, often the cheek patch is entirely white, and again there is a narrow half-moon shaped upper portion of bright red, possibly an age character.

In many ways the Sudan and West African Crowned Cranes are similar to those from East and South Africa; in many other ways, they are much different.

KEY TO THE CROWNED CRANES

- A. Upper one-third to one-half of the bare cheek patch white, the lower portion pink. Throat wattle small. Feathers of the neck dark slaty gray. The bird is smaller.
 - a. General color lighter. Bill horn-colored at tip.
White part of bare cheek patch larger. *B. pavonina pavonina*
 - b. General color darker. Bill wholly black. White part of bare cheek patch smaller. *B. pavonina ceciliae*
- B. Cheek patch white with small upper portion red. Throat wattle large and pendant. Neck feathers pearly gray. The bird is larger.
 - a. Upper margin of bare cheek patch rounded. *B. regulorum regulorum*
 - b. Upper margin of the bare cheek patch with a knob-like process.
..... *B. regulorum gibbericeps*

THE WEST AFRICAN CROWNED CRANE

Balearica pavonina pavonina

This is the only crane found in West Africa between the equator and the Sahara Desert. It was first described by Linnaeus (1758) from "Africa."



FIG. 1

AFRICAN CROWNED CRANES

Ranges of subspecies: (1) *Balearica pavonina pavonina*, West African Crowned Crane. (2) *Balearica pavonina ceciliae*, Sudan Crowned Crane. (3) *Balearica regulorum gibbericeps*, East African Crowned Crane. (4) *Balearica regulorum regulorum*, South African Crowned Crane.

Mackworth-Praed and Grant (1952) gave the type locality as Cape Verde, Senegal. Its range has been established from Senegal to Lake Chad, south to Sierra Leone, Ghana, northern Nigeria, to the middle Chari River.

Blyth and Tegetmeier (1881) wrote that this bird had only once been found on the Sahara, on the dry sands of the Guerah-el-Tharf by Canon Tristram. They also wrote that it was found rarely on the River Volta, but more commonly on the Gambia and Niger Rivers. It was also found in the countries of the Gambia and the Gold Coast, in Fida, at Cape Verde, in Whida, and along the River Ponny, in Guinea.

Bannerman (1931) wrote that it was common in certain places in Gambia, and that it bred at Niamina. At Sallikenni and other similar places it was often found in flocks of a hundred or more. In Sierra Leone the first and

only record at that time was during April 1930, on the Little Scarcies River. It was more common in Nigeria and Gambia than in the Gold Coast but was increasing there. In Nigeria it was generally and plentifully distributed north of 10° lat., yet nowhere so common as in Hausaland, where great flocks occurred.

Bannerman (1951) wrote that huge flocks of birds occurred at Bornu and near Lake Chad but it was less common from August to November in the inundation zone of the Niger River. In the dry areas of the Bauchi Plateau the birds can be seen at all seasons.

There are specimens in the British Museum from Portuguese Guinea (Gunnal); Nigeria (11 miles N of Kafanchan, Zaria) (northern Nigeria); Ghana (Accra, Nr. Tamale).

Description.—Adult: The sexes appear similar in plumage but the male is larger. General color; dark slaty gray passing into black, especially on the upperparts, where the feathers are pointed and more or less falcated. Wing coverts white; the inner greater coverts straw-colored and composed of distintegrated plumes; primary coverts and alula white. Primaries black; secondaries maroon-chestnut, the innermost ones a little broadened and lengthened and slightly decomposed. Tail black. Crown covered with velvety-black, short feathers. Occiput with a tuft of straw-like bristles; each bristle is a spiral, white on one side, brown on the other, and black at the extreme tip. These bristles all radiate from a small spot and spread in all directions out from the back of the head. Lores, sides of face, and cheeks bare; the upper one-third white; the lower part pink. Throat covered with black down; the middle portion bare, covered with red skin in two very small wattles about 2 cm long with a fold between. Neck feathers, especially those of the lower portion in front, elongated and lanceolate and a little lighter than the back. Bill and legs black. Iris white, or very light blue.

Six specimens in the British Museum are listed in Table 1 giving the measurements of all four forms. Many of the other birds were in the U. S. National Museum, Museum of Comparative Zoology, and The University of Michigan Museum of Zoology. Those in the British Museum were measured by Shane Parker.

THE SUDAN CROWNED CRANE

Balearica pavonina ceciliae

The Sudan Crowned Crane, first described by Chalmers Mitchell (1904a, b), is smaller and darker than *B. p. pavonina*. The tip of the beak is supposed to be black and the white cheek patches red below and with a much smaller white area above. The West African bird is supposed to have a horn-colored bill tip and a larger white area on the cheeks. However, I noted many of the wild Sudan birds had horn-colored bill tips in February, apparently from their feeding on the dry baked soil.

Although the type was taken at Khartoum, this bird now rarely, if ever, occurs there. It is found on the Upper White Nile and its tributaries south of Kosti, and in Ethiopia and northern Uganda. In Sudan it has been found in the Provinces of Darfur, Khartoum, Blue Nile, Upper Nile, Bahr el Ghazel.

TABLE 1
MEASUREMENTS OF CROWNED CRANES

Number measured	Sex	Wing	Tail	Tarsus	Bare tibia	Middle toe	Exposed culmen	Crest	Weight
<i>Balearica pavonina pavonina</i>									
1	Male	585	275	203	156	116	64		
1	Female	506	241	196	156	107	53		
6	Both	547.5	244.3	196	146.5	115.3	56.5		
	Extremes	506-585	233-275	190-203	123-156	107-122	53-64		
<i>Balearica pavonina ceciliae</i>									
4	Male	511.7	220	192.5	156.7	113.6	56.2	107 mm	3628.8 g
9	Female	491.1	222.5	187.8	132.1	118.1	54.8	94	3628.8 g
17	Both	496.7	224.3	188.0	134.5	116.4	56.1	100	
	Extremes	470-565	207-252	172-205	100-161	100-129	49-62	94-100	
<i>Balearica regulorum regulorum</i>									
9	Male	560.7	241	205.1	128.6	115.6	63.3	111	
2	Female	523		223		116	62	105	
22	Both	565.2	238.7	207.1	121.2	115.2	61.9	110	
	Extremes	523-642	212-256	183-234	104-142	109-120	57-68	99-122	
<i>Balearica regulorum gibbericeps</i>									
16	Male	565.4	258.6	205.4	133.6	120.5	60.9	123	
14	Female	543.5	250.0	196.8	129.1	120.6	59.7	122	
44	Both	559.4	250.1	201.1	133.8	117.6	59.4	122	
	Extremes	458-615	224-270	170-234	113-161	100-126	52-71	102-132	

and Equatoria (Cave and MacDonald, 1955. and Sudan Natural History Museum). It has also been found in Uganda at Dufile near Numile (Jackson, 1938) and in Ethiopia (Mackworth-Praed and Grant, 1952).

Specimens in the British Museum, Chicago Natural History Museum, and The University of Michigan Museum of Zoology were taken from Sudan from White Nile at Abou Zeit, Fashoda, Kaka, Kodok, Khartoum, Malakal, 12 miles NW of Sengo and Tonga. One in the British Museum was taken in Ethiopia.

These birds spend much of the year in flocks in the Nile Valley. They begin to congregate after the breeding season, in November, reaching a peak in late February and March. We spent 7 days, 3 to 9 February 1962, at Malakal, Sudan observing these birds. At, or shortly after, daylight, the Crowned Cranes flew in small groups out onto the open or semiopen plains where they fed. Sunrise was between 0610 and 0613. Flights out onto the plains began (3-9 February) at 0617, 0607, 0609, 0610, 0541, 0535, and 0558. The numbers increased from 21 on 3 February to 99 on 9 February, and by late February there were several thousand (Stas Wujastyk). The birds were

in small groups, usually one to four (the groups were: 14 flocks of one; 24 of two; 22 of three; 22 of four; 3 of five; 1 of nine; and 1 of 33). In 87 groups there were 273 individuals. The chief departure was between 0540 and 0700. On many days, the flight back to the marshes began at 0710 and lasted until 0800 or later.

Seldom did they fly out in the late afternoon as other cranes do, but there were exceptions. On 2 February, I saw a lone crane flying to the roost at 1806, 9 minutes after sundown. On 4 February, I heard three calling as they flew in the late evening, and on 7 February a small flock was flying down the Nile in the dark at 2200.

On the ground these cranes were rather quiet, but once in the air they began calling, *Ka-wonk—ka-wonk—ka-wonk*. They flew between 100 and 200 meters above ground and usually about 2 or 3 km from the river. They dropped onto the dry, cracked ground, which was like baked clay. They then fed on small grass and other plant seeds. Few insects were to be found. Harry Hoogstraal in a letter (15 March 1962) wrote, "We have not seen the tremendous flocks near the Nile, many of them with mating groups, that we saw in 1961. After having often crawled on the ground among the flocks, searching for the minute seeds that they peck at hour after hour, I have marvelled at how they get enough nourishment to support their large bodies."

THE SOUTH AFRICAN CROWNED CRANE

Balearica regulorum regulorum

This crane was described by Bennett (1834) from "South Africa." Chapin (1939) wrote of its distribution: "Eastern Cape Colony north of the Cunene River, Lake Kabamba on the Lualaba, the eastern Congo border to the vicinity of Mahage, Uganda, and Kenya Colony. Two races are recognized, typical *regulorum* living in the southern part of the range, northward presumably to the southeastern Congo and the vicinity of Zanzibar. *B. r. gibbericeps* of the more northern parts of eastern Africa is closely similar, but the bare skin of the cheeks extends farther upward in the point toward the hind-crown. The species does not seem to extend north of the Cunene valley (in Angola)." Roberts (1951) said it is found: "South of the Congo and Tanganyika to Ngamiland on the west, and eastern Cape Province on the east." Vincent (1952) gave its range in South Africa as: "General except south-west."

There are specimens of *B. r. regulorum* in the British Museum from Nyasaland (Lake Shirwa, Karonga); from Bechuanaland (Mababe Flats, NE of Lake Ngami); Northern Rhodesia* (Kafue River); Southern Rhodesia (Salisbury); the Zambezi River; from

* Since 1964 officially known as Gambia.

South Africa (Transvaal). In the Durban Museum there are two South African specimens, one from Griqualand, East Cape. While in the Pietermaritzburg Museum there is one from Natal and there is one from NW Rhodesia in the Transvaal Museum.

In Northern Rhodesia the Wattled Crane (*Bugeranus carunculatus*) is often more abundant than the Crowned Crane, while in other areas this is reversed. About equal in numbers, neither form is common in Southern Rhodesia. In South Africa, the Crowned Crane is considered the most common crane. However, in many areas, the Stanley Crane (*Tetraptyx paradisea*) is the most abundant.

Description.—*Adult*: Similar to *Balearica pavonina* but a lighter gray. The feathers of the neck are much more pearly gray instead of slaty gray. The crest and the inner greater wing coverts are generally of a paler yellow than with *B. pavonina*. Each bristle of the crest is ringed with white and yellow with black at the tip. Throat naked, with a large red, pendant wattle the base of which is black and continuous with the black velvety feathers around the bare cheek patch. The bare cheek patch varies in color, but the majority are always white. Sometimes there is a small half-moon-shaped, bright red border at the top; sometimes the cheek patch is entirely white. Bill and legs black. Eye grayish-white.

Immature: General color gray with the feathers of the upperparts broadly edged with rufous and those of the underparts with sandy buff margins. The ends of the maroon secondaries darker than in the adult. Head and neck rufous. Crown chestnut with dark bases on the feathers. Lores bare. Remainder of the sides of the face and ear coverts covered with yellowish-white down. Crest small, chestnut. Legs black. Eye light ash color.

Downy young at hatching: Young cranes always appear pot-bellied when newly hatched and they are usually quite weak. Down, about 10 mm long, on back of head, on the back and belly, shorter, about 5 mm, on cheeks. Front of head pale umber; back of head darker; forehead, superciliary area, cheeks, and throat with short pale ivory down shading to light buff. Skin of eyelid pale greenish-yellow. Back; dorsal stripe umber brown with flank spots darker and a caudal spot, shield shaped and darker; shoulder spots darker; general color pale buff. Distal edge of wing light umber; anterior edges buffy, a dark spot at the bend. Belly very pale buff. Chest darker buff. Bare skin above eye slaty tinged with pink. Bill slaty gray, buffy flesh color at base of lower mandible. Base of bill and skin of lower mandible light horn color. Egg tooth pale ivory. Legs generally flesh colored, brightest at heel. Soles of feet pale yellow; each scale on tarsus had a dark base with an outer edge of pale flesh. Nails pale horn color. Eye dark brown.

THE EAST AFRICAN CROWNED CRANE

Balearica regulorum gibbericeps

The East African Crowned Crane was described by Reichenow (1892) from Lake Jipe near Kilimanjaro, Tanganyika. The upper portion of the bare cheek patch is supposed to extend into the black velvety feathers of the top of the head in a more or less swollen knob-like area. Blaauw (1897) pointed out that some specimens show it on one side but not on the other, depending on how the specimen is prepared. If the skin is pulled down

equally on both sides, it does not appear as prominent. The top of the bare cheek patch is red as in *B. r. regulorum*. It is possible that *gibbericeps* might be not separable from *regulorum*.

In the United States National Museum there are specimens from British East Africa: from the head of the Guaso River (9 January 1909); Sotex, Telex River (13 May 1911); Solik, Kabalot Hill (5 July 1911); S. Guaso, Nigiro, Nigara Marsh (6 February 1911); Jekyundu River, Maru (no date); Thika (11 January 1909); Lake Nyanza, Tanganyika (28 February 1920). In the Museum of Comparative Zoology there are specimens from Unyanganyi, Tanganyika (four on 6 December 1929); Nyga za Lake, Victoria (4 March 1910); Sindam Coma, Rutshura, Congo (male, female, and eggs, 11 November 1938); Nyakabande, Ruocda, Uganda (27 January 1939); and Labago, Mwanja, Nairobi, Kenya (17 October 1922). In the Coryndon Museum there are four Kenya specimens from: Kabete, near Nairobi (1 July 1944); Nairobi (17 February 1961); Nakuru Rift Valley (12 January 1958); and Limuru (17 January 1957). There are two female specimens in The University of Michigan Museum of Zoology taken at Lake Manyara (elevation 3,000 feet, 914 m), Tanganyika, in June 1939.

In the British Museum there are specimens from Kenya: Gilgil (9 October 1903, two specimens); Kiboka Swamp (14 August 1899); Loita Plains (6 November 1909); Sattima (30 January 1903, two specimens); Thika (25 August 1914). From Uganda there are specimens: Ihunga, SW Ankole (10 December 1910); Kigezi, Mfumbiro (17 November 1910); Lake Albert Edward Nyanza: Lake George at south end (4, 5, and 6 December 1910); Lake Ruaketenge, Ankole (November 1903). There is one specimen labeled Tanganyika and another from Iringa Uplands (16 February 1932).

Chapin (1939) wrote that Emin found that the Crowned Cranes at Wadelai, on the Bahr el Jebel, had the long neck feathers light ashy-gray and the bare cheek patch pure white with a red border above. Emin also reported Crowned Cranes common around Lake Albert and at Mahagi. *B. p. ceciliae*, he wrote, apparently does not occur south of Lake No. *B. r. gibbericeps* has also been found at the eastern base of Ruwenzori, Lake Edward; throughout the Kivu Highlands; to Lake Bunyoni, 6,700 feet (2,042 m); and in a small marsh on the western slope of Mt. Mikeno, at 7,200 feet (2,195 m).

Jackson (1938) wrote that *B. r. gibbericeps* avoids localities above 7,500 feet. I found this to be the case with *B. r. regulorum* in South Africa. Jackson gave the following localities where *gibbericeps* has been found: Ankole, Athi River, Bombo, Buddu, Elmenteita, Entebbe, Gilgil, Il-polossat, Jinga, Juja, Kendu, Kigezi, Kisumu, Kyagwe, Lekundu River, Mt. Elgon, Mpumu, Mumias, Nairobi, Naivasha, Nakuru, Nandi, Njoro, Pesi Swamp, Rombo, Ruatenge, Ruibale, Thika, Toro, and Tsavo. Dean Murray (verbal) found the species common at Arusha, Tanganyika.

The discussion that follows pertains chiefly to the South African Crowned Crane with which I did the most work.

HABITAT AND ASSOCIATES

Plants.—Plants on the Crowned Crane breeding grounds in Natal, South Africa, were: (Gramineae): *Pennisetum thunbergii* Kunth., *Andropogon appendiculatus* Nees., *Arundo donax* L. (probably escaped), *Miscanthidium* (sp.). (Cyperaceae): *Carex* (sp.), *Cyperus denudatus* Linn. f.; *Cyperus fastigiatus* Rottb., *Scirpus inclinatus* (Del.) Aschers et Schweinfurth ex Boiss [= *S. corymbosus* (Roth ex Roem. et Schultes) Heyne], *Pycreus unioides* (R. Br.) Urban = [*P. angulatus* Nees.], *Pycreus oakfortensis* C. B. Cl., *Ascolepis capensis* Ridley. (Orchadaceae): *Disa cooperi* Reichb. fil. (Gentianaceae): *Chironia krebsii* Griseb. (Iridaceae): *Dierama* (sp.) and another plant, probably *Cyrtanthus* (sp.).

Plants were identified by Colonel Jack Vincent and his men of the Natal Parks and Fish Preservation Board.

In Northern Rhodesia some grasses found were: (generic names), *Panicum*, *Sporobolus*, *Chloris*, *Hyporrhinia*, *Setaria*, *Brachiaria*, *Digitaria*, and *Echinochloa*. These were in the vicinity of where I found two Crowned Crane nests in January. W. L. Robinette aided me in their identification. Robinette found a Crowned Crane nest on 18 February 1962 in this same area (Lochinvar Ranch, near Monze) and wrote (letter, 12 July 1962) that the grasses around the nest were *Setaria*, *Eragrostis*, and *Sporobolus*. Acacia trees in the general vicinity were *Acacia sieberiana*.

Other birds using same marshes.—Species of birds found on the marshes inhabited by the Crowned Cranes in South Africa included Black-necked Heron (*Ardea melanocephala*), Yellow-billed Egret (*Mesophox intermedia*), Cattle Egret (*Bubulcus ibis*), Cape Bittern (*Botaurus stellaris capensis*), White Stork (*Ciconia ciconia*), Sacred Ibis (*Threskiornis aethiopicus*), Hadedah (*Hagedashia hagedash*), Yellowbill Duck (*Anas undulata*), Red-billed Teal (*Anas erythrorhyncha*), Spurwing Goose (*Plectropterus gambensis*), Secretarybird (*Sagittarius serpentarius*), Marsh Harrier (*Circus ranivorus*), Wattled Crane (*Bugeranus carunculatus*), Stanley Crane (*Tetrapteryx paradisea*), Stanley Bustard (*Neotis denhami stanleyi*), an unidentified rail, Ethiopian Snipe (*Capella nigripennis*), Marsh Owl (*Asio capensis*), several species of swallows, crows, starlings, and widow-birds. In the Rhodesias there were more shore birds, storks, and herons, as there were in East Africa and Sudan.

During the breeding season the Stanley Crane occupied a different niche in the environment than the Crowned Crane. The majority of Wattled Cranes, even though they used the same marshes, nested during a different season. Usually the Crowned Cranes nest in the summer, December to February, while the Wattled Crane during the drier winter months, April to October. On one occasion Rudyerd Boulton found the nest of a Wattled

Crane in April and during the January following this nest was being used by a pair of Crowned Cranes. Although the Wattled Cranes are larger and more dominant, they allowed the Crowned Cranes to approach or to feed fairly close to them at times.

Other life.—A crab (*Potamon* sp.) was found on all crane areas, and I found remains of it on several crane nests where they had been fed to newly hatched young. A frog (*Rana fasciata*) was also found on the same regions. Two unidentified snakes were observed, one of which tried repeatedly to swallow a Crowned Crane egg in Northern Rhodesia as we worked in a blind 15 m away. The cranes soon discovered the snake and drove him away. Under normal circumstances this probably would not have happened because the birds would not have been away from their eggs very long. Probably in most areas now mammals do little damage to the Crowned Cranes. In South Africa large herds of cattle pasture around and through the nesting marshes. On one occasion I watched a pair of cranes drive two steers from their nest site. When the cattle peered through the sedges surrounding the small nest clearing, the incubating crane rose and began calling. Immediately its mate flew to its side and the two of them, side by side, advanced with outspread wings towards the cattle, which retreated rapidly.

ROOSTING AND FLOCK SIZES

The Crowned Cranes were breeding at Lochinvar Ranch, Monze, Northern Rhodesia, when we were there 22–25 January 1962. Consequently, they were mostly to be seen in pairs, 17 of which we saw, but three lone birds were also seen. At Salisbury, Southern Rhodesia, 3–4 December 1961, a pair of Crowned Cranes were roosting at Rainham Dam area in nearby trees. This, as was found later, was just prior to their breeding season. There were three cranes here. On 3 December, one crane went to roost at 1825 and left the next morning at 0545 (sunrise 0512) while two others (the pair) flew at 0546. The lone bird fed during the day on a pasture field about 1 mile from his roost tree; the pair fed in the same pasture but some little distance from the lone bird. At 1112 the lone crane flew back to the dam to drink and was followed at 1114 by the pair. When they arrived at the dam, the lone bird flew back to the same pasture. The pair remained at the dam, preening, drinking, and bathing until 1129, when they flew back to the field where they remained until 1715. Then they flew to another roost tree 100 m from the tree in which they had roosted the previous night. On 12–13 January 1962 this pair was nesting, the young hatching on 13–14 January. At this time the birds roosted in the marsh, one over the young and the other standing nearby. Later in January in Northern Rhodesia one bird was found roosting in an acacia tree at night. We frightened him from this tree as we walked

by in the dark. He flew off into the night, calling mournfully. Many Crowned Cranes in South Africa also roosted in trees, but the mate to the incubating crane in each case roosted in the marsh near the nest. At some of these nest sites there were no trees within 1 or 2 km, yet in others there were nearby trees.

At Nottingham Road, Natal, South Africa on 8 December 1961, I watched two Crowned Cranes leave their roost area at 0449 (sunrise 0459). They had been roosting in shallow water along the edge of a dam, and flew into a neighboring wheat field. Three Stanley Cranes flew at 0445; two more at 0459, and seven at 0500. Hadedahs were flying at 0500 as were Sacred Ibis and a flock of 81 Cattle Egrets. In Northern Rhodesia the pattern was about the same.

In the Mooi River-Drakensberg Mountain area of Natal, South Africa, I observed, 8 December 1961 to 9 January 1962, 12 lone Crowned Cranes, 19 groups of two, two groups of three; one with 19, and two with 28 cranes. The majority of the birds were on their breeding marshes and these flocks were nonbreeding individuals. The percentage of Crowned Cranes in pairs in South Africa and the Rhodesias was 59.01 and of birds in nonbreeding flocks, 40.98 per cent.

The Crowned Cranes in Kenya apparently nest at a different season since at Lake Naivasha on 2 December 1961 I observed a group of three.

COURTSHIP BEHAVIOR

Cranes apparently mate for life. They usually nest once each year and if successful they retain their family group for 9 or 10 months. The young raised the previous season are driven away and the pair prepares to nest again. Prior to nesting they exhibit a spectacular courtship behavior, the dance. Both male and female participate, but usually the male is the aggressor. Crowned Cranes begin their dance differently than do other cranes that I have observed. Without moving their body, they bob their heads up and down four to ten times. Sometimes this is all they do, but often they begin to bow. Then, spreading their wings, they jump 6 to 8 feet into the air with legs drooping motionless beneath them. Sometimes between hops they pick up objects from the ground and toss them into the air. Sometimes they call, sometimes not. The dancing crane often goes completely around his mate doing all this and sometimes both birds dance opposite each other. Sometimes one does the dancing, again the other.

Nonbreeding cranes also have a dance. The actions are very similar to those of courtship. A year-old Crowned Crane, which had been hand-reared, jumped all over the yard when it was released from its evening pen in Northern Rhodesia. We had a Sandhill Crane (*Grus canadensis*) that we

raised, which danced and jumped each morning or every few mornings, after it was 5 days old. However, cranes seem to prefer to do this when there is more than one. In nonbreeding flocks one must consider that they may be securing mates, and in these flocks the dance may be a courting display.

AGGRESSIVE AND DISTRACTION BEHAVIOR

When some enemy, man, cattle, or snake, approached a Crowned Crane nest, the birds showed distraction display. Sometimes the birds went through the dance procedure together; sometimes one or the other went through part of it. They used the head-bobbing display quite frequently. Sometimes they spread their wings, showing the large white patches, and ran around the intruder. Again they jumped up and down with their wings half outspread. When running around they often bent their legs and crouched down with head bent low. Sometimes they picked up objects from the ground and tossed them into the air.

Aggression was similar but more decisive. They seemed to know which enemy would retreat if they attacked it. For example, they drove a snake and two steers from nests, but when I came to the nest they remained nearby demonstrating. In aggressive attack they spread their wings and approached the enemy with arched neck and lowered head. They advanced together, side by side, the right wing of the one bird touched the left wing of the other. If the enemy did not retreat, when they were very near, they jumped at it and with wings flapping, feet kicking, and bills stabbing, soon routed it from the nest vicinity.

NESTING

Nest sites were in open marshes where a few centimeters of standing water and knee- to shoulder-high sedges and grasses produced isolation. The vegetation was higher immediately around the site so that when I was searching for nests, I usually worked through the regions of tallest grasses and sedges. All nests were susceptible to flooding. The average water depth around six nests of the South African Crowned Crane in Northern and Southern Rhodesia and South Africa was 12.1 (8-18) cm. The nests were mere piles of grasses and sedges pulled from the immediate vicinity. In the region of the six nests that I observed, all of the vegetation was completely trampled down for a distance of about 5 m in every direction. The birds had pulled nest material from this region and in so doing had trampled down the remainder. The six nests averaged in diameter 70.2 by 77.6 cm, varying from 50.8 by 52.3 up to 76 by 86 cm. The nests were neat piles with a well-cupped center on top for the eggs. The average height above the water was 12.2 (8-18) cm to the rim. Wyndham (1940) described one nest almost 2 m

TABLE 2
NESTS OF THE SOUTH AFRICAN CROWNED CRANE OBSERVED BY THE AUTHOR 1961-62

Nest number	Date found	Date eggs were laid	Date eggs hatched	Where found
1	11 December		21-22 December	South Africa, Natal, 11 miles WSW of Rosetta
2	31 December	Between 23-30 December	28 January*	South Africa, Natal, 20 miles WSW of Rosetta
3	6 January		Unknown	" " " " "
4	13 January	After 4 December	13-14 January	Southern Rhodesia, Salisbury, Rainham Dam
5	23 January		Unknown	Northern Rhodesia, near Monze, Lochinvar Ranch
6	23 January		23-24 January	" " "

All nests had three eggs except number 3, which had one egg.

* Hatching date obtained by William Barnes.

across at the base with a cupped portion 23 cm across, which was about the same at the top as the six nests I saw (see Table 2).

The pH of the water in the Crowned Crane marshes in Natal, South Africa, was 6.0 to 6.3; at Rainham Dam, Salisbury, Southern Rhodesia, it was 7.0 where the cranes nested while at the dam the pH was 8.0. At Lochinvar Ranch, near Monze, Northern Rhodesia, the pH was 7.5.

Nests of the other three Crowned Cranes have been described as very similar. The smaller northern birds may often nest in much deeper water.

THE EGGS

Crowned Crane eggs are pale bluish in color, unspotted, and unstreaked when newly laid. They are often glossy and in shape are ovate or pointed ovate. They soon become stained, and at hatching time are dirty brownish or greenish with an almost white background. Charles Wyndham (1940) wrote, "The ground colour of the shell is a pale greenish-blue of a shade practically identical with that of the normal heron type, but differing from the latter in being thinly incrustated over almost the entire surface with a dull-white chalky deposit similar to that found on the eggs of the various species of cormorants."

Twenty-four South African Crowned Crane eggs from South Africa measured 86.04 (78.3-93.4) by 56.21 (50.4-58.4) mm and 15 eggs from Northern and Southern Rhodesia were 86.41 (77.0-93.9) by 57.7 (56.9-59.0) mm. The average measurement of the 39 eggs was 86.19 by 56.78 mm. The average weight of 13 eggs was 149.66 g varying between 126.1 (at hatching) and 182.0 (when fresh).



FIG. 2. Crowned Crane nest near Broadmoor, Natal, South Africa, 16 December 1961.

Out of 17 recorded sets from the Rhodesias, 10 contained three eggs, 3 contained two, and 4 contained one, averaging 2.35 eggs per set. From all four provinces of South Africa, there were 11 sets with three eggs, 4 with two eggs, and 2 with one, averaging for 17 sets, 2.53 eggs. The 34-set average for the Rhodesias and South Africa was 2.44 eggs.

Wyndham (1940) found that the first egg was laid 4 days before the second and the third egg 3 days after the second. One nest that I found in South Africa had all three eggs laid during a week's period, but I did not know how many days came between the laying of each.

Chapin (1939) wrote of the eggs of *B. r. gibbericeps*, "pale blue . . . 79.6-86 × 56.5-58 mm. Two eggs usually compose a set, and they are said to become a dirty brownish as incubation advances." Jackson (1938) wrote, "eggs two to three in number, are dull white with a greenish tinge, but with a fair amount of gloss, and measure 85-88 × 56-60 mm."

Eggs of *B. p. ceciliae* are also a very light blue, almost white, and after incubation has progressed, became rusty stained. In two sets of eggs in the Sudan Natural History Museum, three eggs in one set (403) measured 73.5 × 53.2, 78.1 × 57.1, and 78.1 × 57 mm, and the two eggs in the second set (404) were 70.4 × 52 and 71.4 × 53 mm. The five eggs averaged 74.3 × 54.46 mm. These were taken by J. G. Meyers prior to 1950 in

Equatoria Province, Sudan. Mackworth-Praed and Grant (1952) gave the measurement average as 80×53 mm.

Bannerman (1931) wrote that with *B. p. pavonina* the egg is pale blue, two or three constituting a set. Later Bannerman (1951) reported that two sets of eggs, one of three and one of two, were found on 30 July and 22 September. The eggs were ovate or rounded ovate, white, stained with yellow and brown. Beneath the chalky top layer they appeared pale blue sparingly marked with small brown and chocolate spots. Some had no markings. The average measurement of the five eggs was 77.8×56.6 mm with extremes of 79.8×55.3 , 76.0×58.5 mm maximum and 76.4×55.0 mm minimum. The nests in which these eggs were found were haphazard accumulations of grasses. One measured 76 cm across, the other 76×102 cm.

NESTING SEASON

The nesting season in different parts of Africa apparently depends on the rainy season. At Dakar, Senegal, the rainy season is from July to October. Bannerman (1931) wrote that Welman found a nest with three eggs in a swamp at Gashua, northern Bornu, in August 1924. It was placed in 5 feet of water and mud—the swamp, the result of the wet-season flooding of the River Yo, was the breeding ground of a large number of these cranes. He saw several pairs at close quarters, flushing several individuals that might have been setting during the last week in August.

In Sudan, the rainy season comes between May and August at Malakal and vicinity. From existing records, the breeding season begins in June and extends into August. However, some birds may nest later, for I found a pair with two young about 6 weeks old on 4 February 1962, indicating that they had eggs about 25 November 1961. This was at Khor Adar, 80 miles north of Malakal. Mackworth-Praed and Grant (1952) gave the breeding season of *B. p. ceciliae* as September to November but this cannot be the average because all of the family groups I observed in February had fully grown flying young with them.

Chapin (1939) reported that Dr. Baquaert found a nest with two downy young, in a small marsh on the western slope of Mt. Mikeno, Congo on 22 March 1927. There is an egg set in the Museum of Comparative Zoology taken at Sindan Goma, Rutshura, Congo, 11 November 1938. Other *B. r. gibbericeps* nesting records given by Chapin (1939) included one from Dr. van Someren, who reported nests in Kenya Colony in June and July, built among reeds in a swamp. Paget-Wilkes found a nest near Kitale, Kenya Colony, 17 September.

Jackson (1933) wrote: "It breeds in both Kenya Colony and Uganda

between May and July. Two nests were 8 May 1903 at Naivasha and 2 June 1907 at Nairobi.”

I observed a pair of East African Crowned Cranes at Lake Naivasha, Kenya, 2 December 1961. They had a fully grown young bird with them which could fly very well. This bird must have been hatched at least by June or July.

Concerning *B. r. regulorum* in Northern Rhodesia, Benson and White (1957) gave records from December to January. Benson (1960) wrote of the Rhodesias and Nyasaland, “The few data in the check list . . . point to this species being a rainy season breeder . . .” The percentage of nesting records given by him were: December, 27 per cent; January, 47 per cent; March, 8 per cent; and April, 12 per cent. Smithers, Irwin, and Paterson (1957) gave ten breeding records for Southern Rhodesia for January and one for February. Benson (1940, 1953) gave two breeding records for January, one for April, and one for May from Nyasaland.

Roberts, McLachlan, and Liversidge (1958) gave the nesting season of *B. r. regulorum* in South Africa as being between December and February. But there are some records as early as 1 November and as late as March. Some definite breeding records for *B. r. regulorum* are given below:

Northern Rhodesia.—Kaesmpa District, Kafue National Park: (1) 1 June 1959 (fully grown young able to fly with parents), Uys (Benson, 1960). (2) 20 July 1959 (young bird, two-thirds grown), Ansell (Benson, 1960). Luangwa Valley, Nsefu Game Reserve: (1) Late April 1958 (fully grown young bird unable to fly), Shenton (Benson, 1960). Monze, Lochinvar Ranch: (1) 23 January 1962 (three eggs), L. and C. M. Walkinshaw. (2) 23 January 1962 (two eggs, one young), L. and C. M. Walkinshaw. (3) 18 February 1962 (three eggs), W. Leslie Robinette.

Southern Rhodesia.—Gwelo District, Guinea Fowl: (1) 1 January 1951 (two eggs), Mr. Salmon. (2) 15 February 1953 (three eggs), Mr. Salmon. (3) 26 January 1955 (two eggs), Mr. Salmon (all three records from file cards of Southern Rhodesia). Matopos Research Station: (1, 2, 3) Three records of three eggs each, all during early January 1950, 1951, and 1952, D. C. H. Plowes (S. R. file cards). Nala: (1) 13 January 1954 (two eggs), I. Cannell (S. R. file cards). Salisbury, Rainham Dam: (1) 11 January 1951 (three eggs), H. M. Miles and R. M. Henderson. (2) December 1959 (parents observed with fully grown young). (3) 9 January 1960 (three eggs). (4) 8 January 1961 (one egg), C. J. Vernon and G. Hopkinson (above records from S. R. file cards). (5) 13 January 1962 (three hatching eggs), L. H. Walkinshaw.

Mozambique.—General: Fairly common on inland vleis but no nests found (Vincent, 1934).

South Africa.—Transvaal: Belfast: (1) 1 January 1908 (two eggs), H. C. Risch (Transvaal Museum, Pretoria). Bloemhof: (1) date ? (two eggs), D. Plowes (Transvaal Museum). (2) 20 March 1938 (one downy young), Miss E. B. Cusack (1943). (3) 13 April 1940 (two large young), Cusack (1943). (4) 10 January 1941 (one egg in nest, two on 13 January), 21 March (small downy young), Cusack (1943). Matlabas: (1) 7 December 1934 (three eggs), Transvaal Museum. Orange Free State: Bloemfontein: (1) June 1906 (two juvenal specimens). Transvaal Museum. Natal: Donn-



FIG. 3. South African Crowned Cranes at nest. Monze, Northern Rhodesia, 24 January 1962.

hauser: (1) 1 March 1904 (two eggs) (Sparrow, 1935). Howick, Shafton House: (1) 19 October 1931 (one egg), R. E. Symons (G. Symons collection). Rosetta, 11 miles west towards Giants Castle: (1) 11 December 1961 (three eggs), L. H. Walkinshaw. Rosetta, 20 miles west towards Giants Castle: (1) 31 December 1961 (three eggs), L. H. Walkinshaw. (2) 6 January 1962 (one egg), L. H. Walkinshaw. Rosetta, 8 miles west: (1) 24 February 1962 (three eggs), G. Symons, Wm. Barnes. Cape of Good Hope:



FIG. 4. Crowned Crane at nest No. 5, Monze, Northern Rhodesia, 24 January 1962 (note white cheek patch, red on top, and large wattles).

Transkei, Kentani: (1) 24 December 1946 (three eggs). (2) 26 January 1947 (three eggs). (3) 1 November 1947 (three eggs). The above eggs were collected by Pitt Fennell and are in the collections of Charles Jerome and Godfrey Symons (Estcourt, Natal). Franklin District, E. Griqualand: (1) 19 February 1931 (three eggs), Transvaal Museum. (2) 22 May 1931 (three eggs), Transvaal Museum.

ATTENTIVENESS OF THE ADULTS

Both adults incubate the eggs and help care for the young. On three of four different mornings the female had been incubating during the morning, the male was incubating on the fourth. On three mornings the first time the birds changed places at the nest came at 0531 (12 December), 0636 (18 December), and 0615 (31 December). The last changes on 2 days came at 1801 (18 December) and 1742 (31 December). All of these observations were made in Natal, South Africa.

On two all-day watches at the nest, the birds changed places seven times (18 December) and six times (31 December). The males incubated for three periods each day. The average on 18 December for the male was 99.6 minutes and on 31 December, 151.6 minutes. The female incubated for three times on 18 December, averaging 102 minutes, and for two periods, 31 December, averaging 116 minutes. Each bird spent more time away from the nest on their first inattentive period. For the male these first periods were 182 and 143 minutes and for the female, 185 and 203 minutes.



FIG. 5. Young South African Crowned Cranes, Rainham Dam, Salisbury, Southern Rhodesia, 14 January 1962.

During 1488 daylight minutes on 2 days, the males were at the nest for 755 minutes (50.7 per cent of the time); the female for 39.8 per cent of the time (592 minutes), and the eggs were unattended 141 minutes (9.4 per cent of the time).

Whereas most cranes when changing places at the nest often give a "Unison Call," the Crowned Cranes did not do so. They flew either directly to the nest or landed some little distance away and walked to the nest through the marsh. When the bird arrived at the nest, the other bird stood and left shortly, flying away to a nearby field (one was 0.5, another 1 mile away). The other bird then sat right down on the eggs. Occasionally the incubating bird rose and turned the eggs, looked all around and sat down again. After a long period of setting on an extremely hot day, the incubating crane sometimes rose and called a mournful *Ooouuw*, *Ooouuw* and stood looking all around as though expecting its mate to come and relieve it. On two occasions when the mate did not return, the male at one nest walked away once for 29 and again for 46 minutes. At a nest we found in Northern Rhodesia, during the early morning, neither parent was at or near the nest. However, on all other nest visits, one parent was there.

TABLE 3
WEIGHTS AND MEASUREMENTS OF CROWNED CRANES AT BIRTH

Number	Weight in grams	Wing	Tarsus	Middle toe	Bare tibia	Culmen	Where found
1	99.3	31.0	39.0	33.0		16.0	South Africa, Natal (nest 1)
2	97.4	28.8	40.3	34.2		19.4	Southern Rhodesia, Salisbury (nest 4)
3	98.3	29.2	41.3	35.2		19.0	" " "
4	97.5	29.8	43.0	30.6		19.1	" " "
5	104.9	30.6	38.8	35.8	20.2	18.8	Northern Rhodesia, Lochinvar Ranch (nest 6)
6	109.0	29.9	41.9	37.9	21.6	17.9	" " "
7	114.5	32.1	37.7	32.1	20.9	20.3	" " "
Average	102.9	30.2	40.3	34.1	20.9	18.6	

Measurements in millimeters.

THE YOUNG

Young South African Crowned Cranes usually hatch on the same or successive days, all hatching within a 24-hour period. Two to 4 days elapse between the laying of the eggs and they hatch between 29 and 31 days after the last egg is laid. A pair of Crowned Cranes (subsp.?) in the Providence, Rhode Island Zoo hatched the last egg 29 days after it was laid. In one South African nest I found the last egg was laid between 28 and 31 December 1961. William Barnes found that one egg hatched on 28 January 1962 at least 29 to 31 days later. A pair of Stanley Cranes hatched the last egg 30 days after the last egg was laid (I knew when the eggs were laid; John Vincent and William Barnes knew when they hatched). One pair of Sandhill Cranes in Michigan hatched one egg of two either 31 or 32 days after it was laid (Walkinshaw, 1950). During 1962, with two pairs in Jackson County, Michigan, incubation lasted either 28 or 29 days. One nest found 8 April contained the second egg 10 April and this egg hatched 9 May. At the second nest, with one egg 21 April, the second egg was laid either 22 or 23 April and both eggs had hatched the evening of 21 May. The youngest bird was still wet at that time.

At hatching time the young Crowned Crane is very weak but within only a few hours is able to leave the nest with its parents. The young at hatching range in weight between 97.4 and 109.0 g, gaining several grams during the first day. Seven newly hatched South African Crowned Cranes averaged 102.9 g (see Table 3). Their pink legs are much lighter colored than the dark gray ones of newly hatched Stanley Cranes.

At a nest at Salisbury, Southern Rhodesia, the parents brought the young back to the nest at night for at least a week. At one South African nest the

family was still found within 100 m of the nest 2 weeks after the young hatched.

From the day of hatching, the entire Crowned Crane family remains intact until long after the young are able to fly. Indications are that the young can fly at about 3 months of age. Most of the time is spent in or along the edge of the marsh in which the young hatch. They feed in much more moist areas than either Stanley or Wattled Cranes but at times they too work onto neighboring fields.

When the family breaks up in 7 to 9 months, the nonbreeding young birds tend to join together in flocks. These flocks spend much of their time feeding in fields. One of the foods appeared to be seeds of grasses, sedges, and grains. When downy, the young were fed considerably on crabs, for I found remains of them on nearly all nests where there were small young.

FEEDING AND FLIGHT

After feeding during early morning hours the Crowned Cranes in Sudan, Kenya, Northern and Southern Rhodesia, and South Africa all seemed to be eating grass and sedge seeds, often picking them directly from the plant. After this type of feeding, if they were not on a wet area, they returned during mid-morning to drink.

Cranes were timed in flight in Sudan, Kenya, and South Africa, and all flew about 120 beats per minute. Speed was about the same as for Sandhill Cranes, 28 to 35 mph.

THE VOICE

The normal call of *Balearica regulorum* sounds like *Ya-ouu-goo-luug*. It is very mournful and penetrating. They also give a single-syllabled *Oouuw*, and at times a double-syllabled similiar call which has probably given them the name of "Ma-hem." Adults call the young to them with a low *Purrrr* quite similar to a call used by *Grus canadensis* (Walkinshaw, 1949), and *Grus grus* (Mountfort, 1957) as well as *Tetrapteryx paradisea*. I have called the young of *Grus canadensis*, *Balearica regulorum*, and *Tetrapteryx paradisea* out of the marsh vegetation where they were hiding by imitating this call.

The call of the Sudan Crowned Crane is much more goose-like, a sharper, *Ka-wouk, Ka-wouk, Ka-wonk, Ka-wouk*. The call of the West African Crowned Crane is very similar to that of the Sudan bird, a loud trumpeting, *Oyak-oyak* or *Quack-quack* (Bannerman, 1931).

The downy young of *Balearica regulorum regulorum* give a shrill peeping-like call.

SUMMARY

Four Crowned Cranes (*Balearica*) have been described from Africa. They have a bill shorter than the head; nostril oval; a tuft of straw-like feathers on the nape, and no

tracheal convolutions in the sternum. Some authors have separated *Balearica* into two species and each species into one additional subspecies.

B. pavonina pavonina is found in West Africa; *B. p. ceciliae* in Sudan, northern Uganda, and southwestern Ethiopia. These cranes are smaller and darker than the others and have the bare cheek patch mostly red (at the bottom) with a smaller upper portion white. *Pavonina* has about one-half white, *ceciliae* about one-third. The West African crane has a horn-colored bill tip, the Sudan crane a black bill (this is not always the case). *B. pavonina* has a very small red wattle.

B. regulorum regulorum is found in southern Africa, from the Cunene River, Congo, and Tanganyika south to Ngamiland and Cape Province. *B. r. gibbericeps* is found in East Africa from eastern Congo, through Uganda to Kenya and Tanganyika. *Balearica regulorum* is a larger crane with a large red wattle and a cheek patch white with a small upper portion red. They are lighter gray in color. Typical *regulorum* has a rounded cheek patch while *gibbericeps* has a slight protrusion of the cheek patch into the black velvety feathers of the top of the head.

Crowned Cranes roost at night either in shallow water of a pool or marsh or in adjacent trees. Nonbreeding Crowned Cranes most often roost in trees, breeding birds in shallow water very near to nest sites (except the setting bird). In Sudan, when the young birds are grown, family groups join into large flocks, separating again into pairs when the breeding season approaches. The breeding season is most often during the rainy season. The northern three forms nest from June to August usually, the South African bird from November to late February.

Crowned Cranes have a dance similar to that of other cranes, but they begin it differently, by bobbing the head up and down about eight to ten times before they begin bowing or dancing. They use this at times as a distraction display. In one aggressive display both birds of a pair walk side by side with outspread wings, advancing toward the enemy with their heads in a threatening position.

Nests of the South African Crowned Crane are large piles of dead sedges, grasses, and reeds, piled into a rather neat nest with a well-cupped center for the eggs. Six nests averaged 70.2 by 77.6 cm across and 12.2 cm above surrounding water which was 12.1 (8-18) cm deep.

Eggs are pale blue when laid, unspotted and ovate to pointed ovate in shape. They become dirty white, with streaks of brownish and greenish. Five Sudan eggs averaged 74.3 by 54.46 mm in measurements. From East Africa eggs have been described as measuring 79.6-88 by 56-60 mm. Typical *regulorum* eggs from South Africa and the Rhodesias averaged (39) 86.19 by 56.78 mm. Thirteen South African eggs averaged in weight 149.66 g, varying between 126.1 (at hatching) and 182.0 (when fresh).

Incubation required between 29 and 31 days and both parents incubate. During three of four nights observed, the female incubated (the male is a larger bird) while during two complete days' observations, they changed places seven and six times, respectively. The male incubated for three periods each day, averaging for the six periods 125.6 (56-203) minutes; the female for three periods 1 day, two on another, for an average of 107.8 (14-182) minutes. The male incubated for 50.6 per cent of the daytime and the female 39.8 per cent.

The eggs in the same nest hatch during a 24-hour period, and the young, in a few hours, become strong enough to leave the nest. However, they return to the nest site for at least 2 weeks to spend the night on the nest. They feed in the marsh near the nest during this period.

The newly hatched young is covered with buffy down with a darker middorsal vertical

stripe. This has two dark horizontal extensions, one over the shoulders onto the wings, the other posteriorly to the mid-back region extending onto the flanks. The face is covered with shorter pale ivory down. The legs are flesh color with the soles of the feet pale yellow. The bill is slaty gray with the base of the lower mandible horn color. The egg tooth is pale ivory. The eye is brown.

The call of *Balearica pavonina* is goose-like, *Ka-wonk*, *Ka-wonk*, *Ka-wonk*, *Ka-wonk*, while those of East and South Africa are much more mournful, *Ya-ouu-goo-lung*. Sometimes these cranes also give a single *Oouuw* or a similar double-syllabled one. When calling the young to them the adults give a typical crane *Purr* call to which the young respond immediately. The young give a shrill peeping.

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